Sodium-activated potassium channels

**Slack**
- Chromosome 9q34.3
- Alternative promoters
- Slow activation with voltage (Slack-B)
- Increased by PKC and mGluR activation
- ~180 pS

**Slick**
- Chromosome 1q31.2
- Rapid activation with voltage
- Regulated by intracellular ATP
- Decreased by and mGluR PKC activation
- Activated by intracellular Cl⁻
- ~140 pS
3-D Structure of Slack-B Channels

Open

Closed

Out

In

Top

100 Å

F. Sigworth et al.
Temporal accuracy increases during high frequency stimulation

![Graph showing temporal accuracy increase with high frequency stimulation.]

- 20 V
- 3 s
- 20 mV

Phase Vector Strength

* indicates significance.
Na\(^+\) rises slowly during repetitive stimulation of auditory neurons

Intracellular Stimulus Train
(2 nA, 0.3 ms pulses at 50 Hz)

(bis-SBFI imaging)
Elevated intracellular Na$^+$ improves phase-locking in MNTB neurons
The Slack activator bithionol increases timing accuracy
Activation of Protein Kinase C enhances Slack currents

Control

100nM TPA

Control

10μM PKC₁₉-₃₁ + 1μM TPA
(PKC inhibitor)
Heteromeric Slack/Slick channels are strongly suppressed by PKC activation.
Under basal conditions, Slack is phosphorylated on two N-terminal and one C-terminal serines.

S34: AGPGDTPAGSAAAPEEPHGPLpSPLLPTR
S43: GGGpSVGSDVGQR
S1211: SDPLAHTpSSSQRS
Responses of Phosphorylation site mutants to PKC activation

S39A

T351A

S360A

S438A

Control

TPA

2 μA

100 ms

2 μA

100 ms

2 μA

100 ms

2 μA

100 ms
Slack mutant S407A fails to respond to PKC activation
Kv3.1

Casein kinase 2

Protein kinase C

S503
Effect of acoustic stimulation on Kv3.1 phosphorylation

MNTB

Left
Control
Right

AVCN

Left
Control
Right
Phosphorylation of Kv 3.1b in MNTB Neurons in vivo is decreased by acoustic stimulation

Left

Right

Monaural stimulation (click trains 600 Hz, 70 dB, 5 min) in left ear

Binaural stimulation

Monaural stimulation (left ear)